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Evaluation of jebsen-taylor hand function test for use in nursing students: close-future outlook

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Abstract

Aim: The purposes of this study are to evaluate the use of Jebsen-Taylor Test with template board in nursing students, to demonstrate the increased ease of placement of test items, and to establish a means of assessing nursing students in a test which requires coordination skills. Material and Method: Our study was performed with Trakya University undergraduate nursing students. This study included 168 students between April 2017 and June 2018. Evaluation of skill and function was performed by the JTT and template board. Results: The study showed the mean durations to complete JTT and subtests in males and females. In addition, p-values were recorded for males and females for each subtest. A statistically significant difference was found in "moving wide, light objects". Durations for subtests 3 and 5 in our study for both dominant and nondominant hands were shorter than the original article. Anthropometric measurements in our study showed a significant relation only between forearm length and the JTT. Duration of the test was shorter for both hands in subjects who used computer for more than 3 hours than subjects who used computer less frequently. Discussion: This study gives new data for the JTT, using a template board in a sample consisted of nursing undergraduate students. It provides evidence that standard objective measures of hand function can be obtained in the educational and clinical settings. In addition after determining the level of hand skills, various training simulations and technological tools can be developed to increase such skills.

Keywords

Jebsen-Taylor Test; Hand Function; Student

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Introduction

It is accepted that the skill and experience required to perform occupations that require hand skills besides mental activity is influenced by the muscle strength and functional adequacy of the upper extremity [1, 2]. There are studies showing that hand skills can be developed with academic training in different occupational groups. Currently, in some countries, performance testing is used to assess hand skills in the recruitment of staff and students. It is believed that these tests should be used to improve staff health, work quality and safety [3, 4].

The Jebsen-Taylor Hand Function Test is an objective and standardized multiscale measure of hand functions to evaluate functional skills effectively and reliably [5, 6]. Functional skills of the upper extremity occur by coordinated work of neurological and musculoskeletal systems. Voluntary movements are organized for a purpose and its efficiency may be increased by learning and experience. Physical skills and tasks required by professions can affect the strength and functional ability of the hand and upper limb.

The emergence of movements is achieved by the organized work of pyramidal, extrapyramidal, cerebellar and vestibular systems. Sensory receptors in muscles and nerves at fingertips provide important feedback messages. Neuromotor development of hand begins at prenatal period and lasts for lifetime. Fine motor skills develop and change with time, experience and learning beginning from childhood [7, 8]. The qualities of complex and harmonious movements accompanied by upper limb movements vary with age to a certain point.

Assessment of hand function and skills is important in describing the person's ability to perform his/her daily life activities. Hand skills levels may be affected by many factors, including genetic and environmental factors, and may vary in different professions and in different populations. Age, gender, predominant hand, anthropometric measurements, level of education, leisure time activities, active working duration, and psychological factors affect hand skill levels. In short-term motor activities, the hand skill was found to be independent from dominant hand preference and gender [9, 10].

The Jebsen-Taylor Hand Function Test (JTT) is a standard hand function test measure widely used in clinical and practical applications [11]. Tests evaluating hand functions in health vocational training should be practical, standardized, reliable and easy to install.

Some studies evaluating hand function tests define the long test duration as a burden. At the same time, different surfaces or materials can affect the performance of the participant during test application. For this reason, the surface to be tested may need to be standardized with materials such as a template board. Studies that give original results for JTT didn't use a template board to locate materials or standardize plate surface. Uncertain placement of test materials may invalidate the use of these data when the number of subjects in the study is high [2].

The purposes of this study are to evaluate the use of JTT template board in nursing students, to demonstrate the increased ease of placement of test items, and to establish a means of assessing nursing students in a test which requires coordination skills.

Material and Method

Our study was performed with Trakya University undergraduate nursing students between the ages of 18-25. This study included 168 students between April 2017 and June 2018. Our study was planned as a prospective study. Age, gender, demographic characteristics, body mass index, anthropometric evaluations, and dominant hand were recorded to evaluate hand skills. The study was performed first with the dominant hand and then with the other hand. Subjects who had pain, numbness, and/or limitation during upper extremity movements, structural abnormality of the upper extremity, musculoskeletal trauma history during the last 6 months, acute pain during the study, difficulty in understanding the study, or withdrew consent to the study were excluded. Sociodemographic features, anthropometric measurements of hand, and body mass indexes were recorded. Anthropometric measurements included wrist circumference, hand length, forearm length, wrist width, and palm length. For forearm length measurement the distance between the olecranon and styloid process of the radius was measured while the wrist was at 90 degrees flexion. Hand length was determined by measuring the distance between the styloid process of radius and tip of middle finger. For hand width, the distance between styloid processes of radius and ulna was measured. For palm length, the distance between the midpoint of the proximal line that separates finger root of the 3rd finger from palm and the midpoint of the distal line that forms the border between hand and wrist were measured. Hand circumference was measured at a level corresponding to 2nd and 5th metacarpal heads and wrist circumference was measured at the level of styloid processes of ulna and radius.

Evaluation of skill and function was performed by the Jebsen-Taylor Hand Function test. This is a standard test performed by placement of a number of small items in each subset [5, 10, 12]. Jebsen Taylor test includes 7 subtests. These 7 tests are writing a 24-letter sentence, turning 5 cards (6 x 9 cm), picking up 2 paper clips, 2 pennies, and 2 bottle caps into a box, stacking 4 checkers, putting 5 kidney beans into a box with a spoon, moving 5 empty cans, and moving 5 full cans (450g). The time needed to complete each activity was scored by recording in seconds for the dominant hand and the other hand. Performance time was recorded for each of the 7 subtests.

Approval was obtained from Trakya University Social and Human Sciences Research Ethics Committee (Decision No: 2017.04.03). Written informed consents were obtained from all subjects.

SPSS 20.0 Package Program was used for all statistical analyses. Descriptive statistics for numerical variables were given as mean and standard deviation. Descriptive statistics for categorical variables were given as percentage and frequency. Normal distribution of data was checked with Shapiro-Wilk test. Student t-test was used for binary comparison of the groups. Chi-square test was used for categorical variables. One-way analysis of variance was used for comparison of more than two groups. Bonferroni test was used for multiple comparisons after one-way analysis of variance. The significance level was determined as 5% for all statistical analyses.

Results

This study was performed with 168 voluntary students from Trakya University Nursing School. From the students 118 were females and 50 were males. The right hand was dominant in 94 participants. Table 1 shows the mean duration (in seconds) to complete Jebsen-Taylor Hand Function test and subtests in males and females. In addition, p-values were recorded for males and females for each subtest. A statistically significant difference was found only in "moving wide and light objects" (p=0.004).

Table 1. Jebsen Hand Function Test Performance of Nursing Students for Dominant Hand in Our Study Compared with the Values in the Original Study (The mean values for males and females in our study).

Jebson Subtests	Women Mean (SD)		Men Mean (SD)		P
	Nursing Students (N=118)	Original data[1] (N=120)	Nursing Students (N=50)	Original data[1] (N=120)	The mean values for males and females in our study
Subtest 1: Writing	9.50 (2.06)	11.7 (2.1)	10.22 (2.50)	12.3 (3.5)	0.053
Subtest 2: Simulated card turning	4.64 (1.14)	4.3 (1.4)	4.51 (0.84)	4.0 (0.9)	0.453
Subtest 3: Small objects	5.84 (0.99)	5.5 (0.0)	5.93 (1.08)	5.9 (1.0)	0.582
Subtest 4: Eating simulation	6.99 (1.36)	6.7 (1.1)	2.42 (1.24)	6.4 (0.9)	0.856
Subtest 5: Arrange checkers	2.33 (0.51)	...	7.03 (1.45)	...	0.476
Subtest 6: Large light objects	3.80 (0.62)	3.1 (0.5)	3.50 (0.53)	3.0 (0.4)	0.004*
Subtest 7: Large heavy objects	4.60 (0.80)	3.2 (0.5)	4.45 (0.63)	3.0 (0.5)	0.240

1Jebsen ve ark.[5]

Table 2. Values for dominant and non-dominant hands for some subtests of Jebsen-Taylor hand function test (the mean data for each subtest)

Jebson subtests Mean (SD)		Nursing Students (N=168)	Original data[1] (N=120)	Harte et al.'s data[2] (N=30)
		Mean (SD)	Mean (SD)	
Subtest 2: Simulated card turning	(ND)	4.88 (1.46)	4.8 (1.1)	4.34 (1.05)
	(D)	4.60 (1.06)	4.3 (1.4)	3.92 (0.92)
Subtest 3: Small objects	(ND)	6.27 (1.11)*	6 (1)	6.61 (1.02)
	(D)	5.8 (1.02)*	5.5 (0.8)	6.38 (1.35)
Subtest 5: Arrange checkers	(ND)	2.70 (2.38)*	3.8 (0.7)	3.95 (0.84)
	(D)	2.35 (0.80)*	3.3 (0.6)	3.27 (0.56)
Subtest 6: Large light objects	(ND)	3.70 (0.60)	3.3 (0.6)	3.12 (0.59)
	(D)	3.71 (0.61)	3.1 (0.5)	2.91 (0.54)
Subtest 7: Large heavy objects	(ND)	4.89 (1.34)	3.3 (0.5)	3.25 (0.53)
	(D)	4.56 (0.75)	3.2 (0.5)	3.03 (0.56)

[1]Jebsen ve ark.[5], 2Harte ve ark.[14]

Table 2 shows the comparison of subtests number 2, 3, 5, 6 and 7 with results of Jebsen et al. study and Harte et al. study. Durations for subtests 3 and 5 in our study for both dominant and nondominant hands were shorter than in Harte et al. study. The only duration for subtest 5 was shorter than the original article. Anthropometric measurements in our study showed a significant relationship only between forearm length and the Jebsen-Taylor hand function test. We concluded that anthropometric measurements do not affect hand function (Table 3).

Sociodemographic features of the participants were evaluated. The difference between students graduated or not graduated from health vocational high-school was not statistically significant. But students graduated from health vocational high school completed the test in a shorter duration with the dominant hand. Duration of the test was shorter for both hands in subjects who used computer for more than 3 hours than subjects who used computer less frequently (p=0.018 and p=0.011). No significant difference could be found for other sociodemographic features (Table 4).

Table 3. Correlations between test duration and anthropometric measurements of forearm and hand, age, and BMI.

Parameters	Test duration			
	p (women)		p (men)	
	Dominant	Nondominant	Dominant	Nondominant
Age	0.88	0.79	0.51	0.10
BMI	0.96	0.49	0.70	0.67
Forearm length	0.34	0.14	0.008*	0.45
Hand length	0.16	0.41	0.14	0.47
Palm length	0.28	0.15	0.88	0.09
Wrist circumference	0.19	0.26	0.98	0.60
Wrist width	0.30	0.17	0.16	0.20
Hand circumference	0.27	0.34	0.37	0.66

Table.4. Association of test duration with sociodemographic features in our study

Demographic features N		Dominant		Nondominant		
		Mean (SD)	p	Mean (SD)	p	
Graduation	Health vocational high school	39	37.14 (4.5)	0.19	58.74 (9.8)	0.091
	Other high school	128	38.25 (4.7)		55.77 (9.4)	
Family income status	Low	31	37.81 (4.2)	0.82	57.03 (9.7)	0.69
	Good	137	38.01 (4.7)		56.29 (9.5)	
PC, tablet pc, laptop etc.	2-3 hours /day	106	38.62 (4.6)	0.018*	57.85 (9.9)	0.011*
	3 hours or more / day	62	36.87 (4.5)		53.98 (8.4)	
Working in a part time job	Yes	77	37.45 (5.3)	0.18	55.37 (10.4)	0.18
	No	91	38.42 (4.0)		57.32 (8.7)	

Discussion

This study gives new data for the Jebsen-Taylor Hand Function Test using a template board in a sample consisted of nursing undergraduate students.

Tests used by 92% of the members of American Hand Therapy Association were evaluated. The results showed an increase in the use of self-performed hand function measurement tests [13, 14]. These applications speed up hand function evaluations. However, a comprehensive hand function assessment should include evaluation of hand activity, body functions, and hand structures.

JTT is an important tool to evaluate hand function skills [15]. Some previous studies criticized JTT as time-consuming [2, 16]. Reliability, validity and positive predictive value are important for all scales [17]. Previous research has shown that including a template board enables proper location of hand function test. It also helps specialists to install the test properly and to provide reproducibility [16].

Our study demonstrated practical time benefit of using a template for JTT. It increased the accuracy of subtests and provided time. In our study using a template board also enabled re-installation of subtests for each participant.

In our study time to complete subtest 3 (small objects) and subtest 5 (checkers) were significantly low. In the study by Harte et al., participants completed subtest 2, 6 and 7 in shorter durations for both hands than the original JTT study. In addition, subtest 5 was finished in a shorter time than the original study for the dominant hand.

Subtest 2 does not require a template board. When a template board is not used a specialist should locate test material at a correct distance from sides of the table and from one another. Time loss is inevitable.

Use of a template board helped installation of test especially for 5th, 6th, and 7th subtests. In addition, it helped to tell the test to students. Understanding the test more easily increased participants' enthusiasm for the test. It enabled creating an equal distance from the side of the table. It made the location of light and heavy objects easier.

Previous research has found that installation of subtest 3 will be the hardest without a template board [2]. We also felt the same in our study.

Comparison of our study with normal data in other studies demonstrated that nursing students demonstrated similar hand function levels in JTT test [5, 18]. The advantage of using a template board was better results in subtest 3 and 5.

Our study provides evidence that standard objective measures of hand function can be obtained in the educational and clinical settings. So, clinical skills of the students can be followed, insights are obtained about details that should be supported and these can be added to their education programs. Hand function relates to factors such as the ability of a person to develop and use repetitive movements to perform a task. The ability to make safe and qualified interventions in emergency and unexpected situations should be supported by increasing the practice on acquiring hand skills both clinically and practically.

At the same time, our data shows that there is no need for gender discrimination in the nursing profession, which requires hand skills and fine motor skills. No difference could be found between male and female nursing students.

A wider study of the practical use of performance-based hand function tests is recommended. In addition after determining level of hand skills, various training simulations and technological tools can be developed to increase such skills.

In occupations with skill-demanding workloads physical burden and skills required by the job may influence physical performance capacities of people. The data obtained at the end of the study can be used to determine the training needs of employees to increase work efficiency and professional satisfaction. It will give an idea to work on hand force and function in other professions. Our findings may be helpful until reliable norms are established depending on a bigger and more representative sample in nursing profession.

Evaluating hand functions in nursing profession will help in job selection, job performance evaluation, and improving job and staff health. Efforts should be made to improve hand functions and they should be supported by education in professions that require good hand function.

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Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

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